

# Will's Guide To Life, Volume 1

Math 231

Spring 2008

## Preliminaries

A few important things to remember:  $+C$ 's are a must. Remember that the work is more important than the final answer. There is a limit on time, so work hard and work efficiently, do not spend all of your time working any one problem. It is better to have studied too much and be overprepared than to understudy and do poorly.

## Section 6.1

How to use simple substitutions to get an integral to look like the form that we find in an integral table. Learn the integration rules in the table on p. 510 of the book. (The last 4 can be done via trig tricks.)

## Section 6.2

Basic formula for integration by parts:  $\int u dv = uv - \int v du$ . How to choose  $u$  and  $dv$ : Choose your  $dv$  such that it is actually integrable, that is so that  $v$  actually exists. It is a good sign if  $du$  is simpler, or at least not as complicated as  $u$ . It is a good sign if  $v$  is simpler, or at least not as complicated as  $dv$ . Reduction formulas. Integrating by parts for a definite integral.

## Section 6.3

How to deal with  $\int \cos^2 x dx$  or  $\int \sin^2 x dx$  via the half-angle formulas. The Pythagorean identities. (Only need to remember  $\sin^2 x + \cos^2 x = 1$  can derive other two by dividing by either  $\sin^2 x$  or  $\cos^2 x$ .) The different cases of  $\sin^m x \cos^n x$  and  $\tan^m x \sec^n x$  and our strategies for dealing with them. Remember the trig derivatives. Trig Substitutions for integrals with forms like  $\pm a^2 \pm u^2$ . The three different trig substitutions and drawing a reference triangle to get back to the correct variable. (The table on p. 528 of the book is quite nice.)

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## Section 6.4

How to deal with Rational Functions. Using long division if the degree of the numerator is greater than the degree of the denominator. Tricks to look for before resorting to partial fractions. How to deal with repeated factors or higher order (quadratic, cubic, quartic, etc) in the denominator. Completing the square as a method to turn an “ugly” integral into an easier integral or combination of easier integrals. (This is essentially a tool to turn most any quadratic function into a trig substitution.)

## Section 6.6

Improper integrals. A limit of integration is  $\pm\infty$  or there is some infinite discontinuity at some point inside the limits of integration. Dealing with a limit of integration of  $\pm\infty$  by taking limits. We deal with an integral that has an infinite discontinuity on the interval by again taking limits. The ideas of diverging to infinity and diverging by oscillation. The  $p$ -test for convergence of  $\int \frac{1}{x^p} dx$  around 0 and  $\infty$ . Using the comparison test to show an integral converges or diverges.

## Section 7.1

Growth or decay problems. The differential equation they satisfy, the growth constant  $k$ , half-life and how they relate. Radioactive decay. Newton’s Law of Cooling and compound interest. Finding the general and particular solutions of “nice” differential equations.